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DUAL TAPER STEERING COLUMN LOCK BOLT

TECHNICAL FIELD

[0001] The invention relates to a lock for a steering column of a vehicle to prevent the steering wheel from being turned.

BACKGROUND OF THE INVENTION

[0002] Steering columns in vehicles normally include a locking mechanism to prevent turning of the steering wheel when the ignition is off and the key is removed. As shown in U.S. Patent No. 4,258,560, a steering column lock can include a locking plate connected to an upper end of a steering shaft. The steering shaft connects the steering wheel with the steerable tires of the vehicle. The locking plate extends radially from the steering shaft and defines one or more apertures for receiving a locking pin. When the locking pin is inserted in the aperture, the steering shaft is locked.

[0003] The locking pin can define a tapered surface that engages the aperture of the locking plate. The tapered surface can enhance removal of the pin with respect to the locking plate, to enhance and facilitate unlocking of the steering column. For example, the edge of the aperture can slide along the tapered surface of the pin during insertion and removal of the pin, preventing binding between the two parts. However, during unauthorized starting of the vehicle, the steering shaft can be subjected to extreme tortional loading. During the severe torsion that can be generated during an attempted theft of the vehicle, the tapered surface of the locking pin can act as a cam follower surface and the surface of the aperture of the locking plate can act as a cam. In other words, the locking plate can drive the locking pin out of engagement with the aperture when a theft of the vehicle is attempted, making the theft easier.

SUMMARY OF THE INVENTION

[0004] The present invention provides a steering column lock assembly including a steering shaft defining an aperture and a locking pin insertable in the aperture and having first and second tapered portions for limiting cam-cam follower cooperation between the locking pin and the aperture. The tapered surfaces define first and second truncated cone portions having different angles. The locking pin can include a first truncated cone portion narrowing from a first end at a first angle to a second end. A second truncated cone portion can extend from the second end and narrow at a second angle to a third end. The first and second angles are different with respect to one another. The second angle is less than the first angle. The first angle can define a tapered surface to enhance unlocking of the steering column. For example, the first truncated cone portion can make it easier to unlock the steering column by sliding against a locking plate in the steering column. The second angle can define a tapered surface that reduces the likelihood that extreme tortional loading will drive the locking pin out of engagement with a locking aperture defined by the steering shaft. For example, the sliding movement described above is reduced by the second truncated cone portion to deter vehicle theft. The two cone portions cooperate to facilitate enhanced removal of the locking pin during authorized vehicle start-up, while simultaneously restricting movement of the pin during unauthorized vehicle start-up.

[0005] Other applications of the present invention will become apparent to those skilled in the art when the following description of the best mode contemplated for practicing the invention is read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The description herein makes reference to the accompanying drawings wherein like reference numerals refer to like parts throughout the several views, and wherein:

[0007] Figure 1 is a side view of a steering column assembly according to an embodiment of the invention disposed in a vehicle;

[0008] Figure 2 is a partial cross-sectional view of the steering column assembly shown in Figure 1 wherein the locking pin is engaged with respect to a locking plate member; and

[0009] Figure 3 is a partial cross-sectional view of the steering column assembly shown in Figures 1 and 2 wherein the locking pin is disengaged with respect to the locking plate member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] Referring to Figure 1, a vehicle 10 is shown including a steering column assembly 12 mounted in the forward passenger compartment. The steering column assembly 12 extends through the firewall of the vehicle engine compartment and includes a cylindrical upper jacket 14 secured by a bracket assembly 16 to support structure of the vehicle 10. A shift bowl 18 is supported for limited rotational movement on the upper end of the jacket 14 and may be turned by the vehicle operator through a selector lever 20. A generally cylindrical housing 22 is secured to the upper jacket 14 and located between the shift bowl 18 and steering wheel 26. The housing 22 can also support a lever 27 for operating turn signals or headlamps of the vehicle 10. A steering wheel 26 is drivingly connected to a rotatable steering shaft 28 (best shown in Figures 2 and 3). The steering wheel 26 engages the shaft 28 at a hub 29. The shaft 28 extends axially within the steering column assembly 12 to operably connect the steering wheel 26 with respect to the wheels of the vehicle through a conventional steering gear and linkage.

[0011] Referring now to Figures 2 and 3, the steering column assembly 12 according to the invention includes a steering shaft 28 defining at least one

receiving portion 38 and a locking pin 40. The receiving portion 38 can be an aperture or can be a notch. The locking pin 40 is selectively insertable in the receiving portion 38. The locking pin 40 is moveable between at least two positions. In a first position corresponding to a locked position, the locking pin 40 is insertable in the receiving portion to prevent rotation of the steering shaft 28. In a second position corresponding to an unlocked position, the locking pin 40 is disengaged with respect to the receiving portion 38 and the steering shaft 28 is rotatable.

[0012] The steering shaft 28 is shown mounted for rotation in a first longitudinal recess 32 defined by the steering column housing 22. The housing 22 also defines a second recess 34 for receiving the locking pin 40. The locking pin 40 can be slidably mounted within the second recess 34 of the steering column housing 22. The second recess 34 can extend parallel to the first recess 32 and be offset with respect to the first recess 32. In an alternative embodiment, the second recess could extend radially from the first recess.

[0013] The housing 22 is also shown supporting a locking cylinder 24. The locking cylinder 24 can receive a key 25. The key 25 can be inserted in the locking cylinder 24 and rotated to move a gear train 30 and slide the locking pin 40 relative to the housing 22 within the second recess 34. For example, when the key 25 is removed from the locking cylinder 24, the locking pin 40 is inserted in the receiving portion 38.

[0014] A plate member 36 can be immovably associated with respect to the steering shaft 28. The receiving portion 38 is shown defined by the plate member 36, however, the receiving portion could be defined by the steering shaft 28. The plate member 36 is rotatably locked with respect to the steering shaft such that the plate member rotates in response to rotation of a steering shaft 28 and insertion of the locking pin 40 in the receiving portion 38 defined by the plate member 36 prevents rotation of the steering shaft 28.

[0015] The plate member 36 rotates the receiving portion 38 in response to rotation of the shaft 28. During rotation of the plate member 36, the receiving portion 38 intermittently communicates with the second recess 34.

The locking pin 40 can be inserted with respect to the receiving portion 38 when the receiving portion 38 is in communication with the recess 34. As shown in Figures 2 and 3, the receiving portion 38 can extend in parallel relation to the steering shaft 28.

[0016] The locking pin 40 includes a first truncated cone portion 42 narrowing from a first end 44 at a first angle 46 to a second end 48. The locking pin 40 also includes a second truncated cone portion 50 extending from the second end 48 and narrowing from the second end 48 at a second angle 52 to a third end 54. The first and second truncated cone portions 42, 50 can extend concentrically with respect to one another. The first and second angles 46, 52 are different. The second angle 52 can be less than the first angle 46. By way of example and not limitation, the second angle 52 can be one-half of the first angle 46. For example, the second angle 52 can be four degrees and the first angle 46 can be eight degrees.

[0017] The first and second truncated cone portions 42, 50 can be inserted in the receiving portion 38. The receiving portion 38 and locking pin 40 can cooperate in cam-cam follower relationship. For example, the first truncated cone portion 42 can be angled to enhance sliding between the locking pin 40 and the receiving portion 38. Enhanced sliding engagement between the locking pin 40 and the receiving portion 38 can be desirable during authorized insertion and removal of the locking pin 40 with respect to the receiving portion 38. For example, the angled surface 56 of the first truncated cone portion 42 can guide insertion of the locking pin 40 with respect to the receiving portion 38 and alleviate slight misalignments between the two parts. Also, the angled surface 56 of the first truncated cone portion 42 can communicate torsion from the receiving portion 38 to axial force urging the locking pin 40 out of engagement with the receiving portion during authorized vehicle start-up.

[0018] The second cone portion 50 can be angled to be less likely to cooperate in cam-cam follower relationship with the receiving portion 38 than the first truncated cone portion 42. For example, the second truncated cone portion 50 is flatter than the first truncated cone portion 42 to reduce the

likelihood that torsion will urge the locking pin 40 out of engagement with the receiving portion 38. Extreme torsion can occur during an attempted theft of the vehicle. It has been determined that the present invention reduces by one-half the force urging the bolt 40 out of the receiving portion 38 during extreme torsion loading. Specifically, the urging force generated torsion loading

[0019] While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.